IMPERIAL BUREAU OF
HORTICULTURE AND PLANTATION CROPS

OCCASIONAL PAPER No. 6 (War)

HARICOT BEANS

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FOREWORD

TYPES of vegetables that provide proteins are very few indeed and of those commonly grown in England only the seeds of peas and beans have an appreciable protein content. These vegetables (usually purchased in cans) are used in large quantities in normal times and should prove a substitute in case of reduced supplies of meat and fish during the war period.

In normal years the haricot beans of the shops have their origin in Japan, Hungary and North America, for few commercial growers would gamble on a crop that perhaps would only ripen a full crop in years of dry summer.

In wartime the overseas supplies are cut off, the gamble taken, and experiments must be made with these crops in the hope that the climate will prove as kindly as it did in 1940 when crops of over 1 ton per acre were gathered in many parts of England.

The varieties of real haricots available, Comtesse de Chambord, Everbearing, The Pea Bean and Red Kidney are of foreign origin and suited to drier and warmer climates so that the English grower labours under a handicap—yet he did well with these in 1940 and may do so again. It is hoped, however, that some growers will become sufficiently interested in haricots to hybridize and select strains or varieties that are more dependable to ripen a full crop in this country.

The dried seeds of haricots can be stored and provide a very valuable food throughout the winter months. Eaten with the potato they form a balanced meal.

H.V.T.

HARICOT OR DRY-SHELL BEANS

I. Introduction.

In Great Britain the term "haricot" is usually applied only to the dry seed of the dwarf French beans (Kidney Beans).

In France "haricot" accompanied by a qualifying adjective, i.e. vert, nain, à rames, etc., includes all beans derived from *Phaseolus vulgaris* and *multiflorus*, whether dwarf or runner, in whatever form they are used, as snapbeans (young pods which should snap or break when jerked in the hand), flageolets (fully formed, but unripe beans shelled from the pods when too old to use as snapbeans), or dry beans which can be harvested and stored for future use.

In America dry haricot beans are called dry-shell beans, a plain, descriptive, English term which might well be adopted over here.

There is little information available on the production of dried beans in this country. It is not a popular field crop, for when grown under farming conditions the yields are not high and prices are low. The canners, who in normal times should provide the chief market, are able to buy unlimited supplies more cheaply abroad than it pays the farmer to produce at home.

The dry bean does not greatly attract the British housewife unless it is canned, a condition which eliminates the somewhat prolonged period of soaking and cooking usually considered necessary.

In time of war, however, when more accustomed foods may become scarcer, the haricot with its high protein content should prove a valuable substitute in case of reduced consumption of meat and fish. Dry, raw haricots contain 21·4% by weight protein and 52-120 international units of vitamin B_1 compared with the much smaller amounts contained in non-legume crops.

II. Commercial cultivation in U.S.A. and Canada.

Since the cultivation of field beans is a considerable industry in parts of the United States and an increasing one in Canada, the methods and experiences of these countries may be worth considering.

It is not suggested that the varieties used would all mature successfully in Britain in view of our cooler summers, though some of the small, white, pea-bean types which in North America ripen well within the frost-free period should do well over here in normal summers, as should the popular Red Kidney. In England the danger would not be so much from frost as from wet, especially at or near harvest. There are, too, a number of varieties grown in England as snapbeans which fulfil the conditions necessary for success as haricots. These will be mentioned later.

The desirable and, in most cases, essential qualifications in the haricot bean are the following :—

Capacity for being sown and ripened between the risks of killing frosts, i.e. in about 120 days ;

dwarfness ;
hardiness ;
disease resistance ;
capacity to remain erect and hold the pods off the ground sufficiently to prevent weathering ;
non-shattering of pods before or during curing process ; ease of threshing by hand for the private grower ;
ability of seed to resist splitting during threshing ;
size, quality and colour suitable to requirements of canning trade (though in wartime this may be of less importance).

From the canner's standpoint high quality means a bean which can be baked before becoming dry or tough, uniform in size and colour, defect-free, absorbing moisture uniformly, non-splitting and non-disintegrating in baking.

In the United States out of nearly 400 distinct varieties of *Phaseolus vulgaris* (from which most of the garden horticultural beans are derived) described by Hedrick only 55 are suitable for use as field beans and many of these are scarce or only locally successful.

The white beans are mainly grown in the northern and more humid districts of America, the coloured and mottled varieties being preferred in the warmer and more arid regions.

In unfavourable years, i.e. early frost, harvest wet, etc., the pea beans, because of their short growing season, give the best results. They also fulfil the other requirements cited and are acceptable to popular taste.

In U.S.A. in 1918, when a killing frost occurred on September 11th, a month earlier than usual, pea beans alone matured in time to escape serious damage.

The short season beans are followed by winter wheat in the U.S.A. rotation, because very little seed bed preparation is needed for wheat following beans (merely harrowing the bean stubble is considered sufficient) and the beans can be harvested in ample time for the wheat to be sown.

They are essentially a food crop and are not used as a green manure on account of their small size and sparse root system, but though data are lacking it can be assumed that the succeeding crop is to some degree benefited by the available nitrogen left in the decomposing root residue.

Cultural practices in U.S.A. (non-irrigation areas).

Varieties. The principal varieties grown in the northern or more humid bean districts where the climate more nearly resembles our own are as under :—

In Michigan. *White :* Michigan Pea, Early Wonder, Michigan Robust, Vermont Pea. *Coloured :* Red Kidney, Brown Swedish.

In New York. *White :* Michigan Robust, Navy Pea, Blue Pod Medium, York State Medium, White Marrow, Nova Scotia Marrow, Perry Marrow, White Kidney. *Coloured :* Red Kidney, Wells Red Kidney, Imperial Yellow Eye.

The pea bean types (dwarf, green-podded class) are those most usually grown for haricot or dry seed bean, being 90% of the whole in Michigan and 40-50% in New York.

The pea beans are nearly all white-seeded varieties.

Michigan Robust is immune to mosaic and very resistant to anthracnose and blight. Red Kidney is resistant to mosaic.

Soil. Soils which have proved most satisfactory for haricot beans are medium light loams of at least moderate fertility. Heavy clay soils slow to acquire warmth in

spring may cause the seed to rot before germination. Acid soils have also proved unsuitable.

There is little experimental evidence available but a number of tests carried out in 1900 and 1901 (Stone, J. L.) on farms on different soil types resulted in yields heavily in favour of the lighter soils in a normal year and, though to a lesser degree, during a season of drought.

Manuring. Except in the older bean growing districts very little farmyard manure or artificial fertilizer is used.

A survey of a large number of farms using farmyard manure in varying degree showed that an average increase of roughly 3 bushels per acre in a bad season and 4 bushels in a good season followed an application of over 10 tons to an acre when compared with farms using less than half that amount. In only one district, where the increase was 7 bushels annually, would the increase have repaid the cost.

A similar survey of farms using artificials showed small, uneconomic increases in most farms applying them. They were always used in conjunction with small quantities of farmyard manure.

In manurial trials phosphorus is the element which has given the best results. In trials carried out with beans in 1891 dissolved bone black increased yield by 58·7%, potassium sulphate by 38·1%, potassium chloride by 20·4%; nitrogenous fertilizers proved unprofitable. (Kinney, L. F.)

In more recent experiments by Hardenburg (Hardenburg, G. V.) larger amounts than 300 lb. per acre of acid phosphate were unprofitable. Farmyard manure plus 300 lb. acid phosphate per acre increased yields but not sufficiently to pay.

As a general rule resulting from these trials it is laid down that when manure has been employed for the previous crop only acid phosphate is needed, but that should the previous crop have yielded heavily a complete fertilizer, 4:12:4, should be used.

Fertilizer may be drilled in at the same time as the beans are sown, using all the delivery hose except those feeding the bean. Actual contact of the bean or young seedling bean with the fertilizers is to be avoided, the young plants being very susceptible to injury at this early stage.

Soil preparation. Careful preparation of the ground to ensure a fine tilth is considered essential.

Spring ploughing is usual, the average depth being from 8-6 in., the shallower depth being reserved for the heavier soils.

For harrowing a spring-tooth harrow is commonly used. A small minority of farmers use a disc-harrow. From four to six harrowings are given.

Rolling before and after sowing is advised.

Rolling before sowing is either done on the furrow before harrowing or immediately before sowing the beans.

Sowing. In U.S.A. (Michigan and New York) the sowing date lies between June 1st and June 15th. These comparatively late plantings are found to escape bacterial blight, anthracnose and the bean maggot. In Canada mid-May has proved satisfactory; this time would probably prove the most generally suitable for Great Britain also.

Spacing to produce the optimum yield naturally depends on growth habit and soil fertility. In actual practice the inter-row spacing for the relatively tall American pea bean varieties, which are the types usually grown, is invariably 28 in. with the beans 6 in. apart in the row.

Planting is done by means of a grain driller with sufficient holes plugged to produce the necessary spacing. Less frequently a 2-row bean planter is used. Planting depth is from 1½ to 3 in., the greater depth being used for the lighter soils. It is important that the soil should offer little resistance to the germinating seed. Good one-year-old bean seed should germinate about 90%. Temperature has an important influence on speed of germination. Experiments (Reynolds, J. B.) have shown that 19 days were required for the first appearance of the radicle at a temperature of 45°-55° and only 4 days at a temperature of 55°-65° F.

Cultivation. Three to five shallow cultivations are usually found necessary to control weeds. The customary implement is a horse-drawn cultivator. Hand hoeing is sometimes substituted when weeds require to be checked on heavy land that is still too wet for horse-drawn tools.

To avoid covering the young plants as they emerge from the soil, since at this stage beans resent any form of earthing up, guards are often fitted to the cultivator teeth nearest the rows. The bean plant is shallow-rooted and easily injured. Cultivation must, therefore, be conducted with care. Cultivating when the foliage is wet is thought to assist in the spread of the spores of fungus diseases.

Hardenburg says that the often expressed notion that the crop should not be cultivated when the plants are in bloom has no justification in proof.

Harvesting. The method of harvesting and threshing influences the quality and market value. The optimum time to harvest is when the larger part of the pods is mature, before shattering and before many leaves have dropped, so that the feeding value of the bean straw may be maintained, and when dry weather is available for curing. Five to seven days are required. Harvesting when the dew is still on the pods may help to reduce shattering. Except on small acreages, where they are pulled by hand, beans are cut by bean harvesters with knives running 2 in. below the surface, dealing with two rows at a time which fall in a single windrow. The cut plants are made into small piles by a man following the machine and so left for the surface moisture to dry off.

A horse rake is sometimes used. This also collects weeds and soil so that it is then often necessary to fork out the beans from the large weeds. After a few hours the piles are bunched together in larger stooks and left to dry for from 3-5 days according to the weather. Curing by this method of slow drying is reputed to toughen the pods and so prevent shattering, to improve the haulms for forage purposes by reducing the loss of leaves, and by the elimination of surplus moisture to reduce the risk of spoilage after stacking. In the more humid districts the cured plants are stored in barns until threshing.

Threshing. Threshing is carried out by means of bean hullers or temporarily adapted grain threshers. The former threshes the beans by means of two cylinders, one working slowly to thresh the dry pods while the other revolves faster to deal with the greener pods.

Grain threshers are adapted by removing part of the concaves and regulating the speed so as to avoid shattering the seed.

The portion of grain to straw is usually about 1:1.

Storage. If properly cured and dried (14% moisture) beans can be safely stored in bags. In fact, up to 18% moisture is considered safe. The excess moisture is evaporated by placing the beans in bins with sticks or laths inserted to prevent heating.

Kiln driers are also used, the beans being spread in layers 3-4 in. deep over artificial heat. In beans required for seed temperatures from 90°-125° F. will not reduce germination, though lower temperatures are preferable to prevent cracking and shrivelling.

Disposal of the crop. Further cleaning of the beans is done by the buyer.

On arrival at the elevator the beans are passed through a cleaning mill which removes by means of a heavy air blast nearly all the split beans and other debris. After passing through the cleaner the question of price is determined on the hand-picked system in Eastern U.S.A. and on the recleaned basis in the West. On the hand-picked system a sample of about 4 lb. is carefully hand-cleaned of all broken, discoloured or rogue beans and any other debris not removed by the cleaner. This debris may normally amount to 2-5%, but in a wet harvest year it will be higher.

White varieties owing to a greater tendency to discolour usually give a higher "pick" than coloured beans. In determining the price the total weight of the pick is deducted from the total weight of the recleaned beans and the gross value reckoned at market price. A further deduction of 5 cents a pound for the total weight of the pick is then made to the grower to cover the cost of the picking over. Cull beans from the pick are resold to the grower at a nominal price.

On the recleaned system the recleaned beans are simply weighed to determine the recleaned weight.

Further treatment by the buyer is necessary. The beans are mechanically repicked of all except the discoloured beans. These are hand-picked, usually by women.

It is generally necessary to polish white beans to impart a gloss and to remove any discoloration. Brief descriptions with illustrations are given by Hardenburg of the several types of machinery for cleaning and polishing in common use.

Fodder. Cull beans as a feed for stock contain twice as much protein as corn and oats and the same amount of gluten feed.

An objection to feeding them to horses and cattle is that these animals cannot separate dirt and gravel from the culls. They are, however, excellent for sheep. Pigs do well on moderate rations of cooked cull beans.

When used in mixed feed for dairy cows the beans have a feeding value equal to half that of cotton seed meal. Palatability is dependent to a great extent on the other feeds used in the grain ration.

Bean straw is fed in combination with other roughage and compares favourably with cereal straw.

Many farmers in U.S.A. depend on sheep as a means of utilizing the by-products.

Yield. For U.S.A. the average yield of field beans is given as 10-15 bushels per acre though yields up to 25 bushels are often obtained, especially with pea beans which are consistently high yielders, 21 bushels being normal. Part of this comparative fruitfulness is attributed to the resistance of pea beans to bacterial blight.

Diseases. The diseases causing most trouble in U.S.A. are anthracnose, bacterial blight and mosaic.

Anthracnose (*Colletotrichum Lindemuthianum*). Symptoms. A blackening of portions of the veins on the under sides of the leaves and the appearance on the pods of black, circular, sunken spots often having a raised centre and the larger bearing an orange coloured border. The stems of seedlings may also be attacked. The disease is carried through from season to season by infected seed.

There is no control except the use of seed from uninfected plants or resistant varieties. Well-known resistant varieties are Wells Red Kidney and Robust pea bean.

Bacterial blight (*Bacterium Phaseoli*). Symptoms. The appearance on the leaves of small irregular amber-coloured spots which rapidly form large brown dead areas often involving the whole plant. The pod lesions have a watery, irregular appearance soon turning reddish and becoming sunken. The spots are distinguishable from those of anthracnose by the fact that they never develop dark centres. There is sometimes a rotting of the stem at the first joint, and a decided wilting of a part or whole of the plant is a usual feature.

The disease is carried from season to season in the seed.

There is no certain control other than the use of clean seed. Robust is the only blight-immune variety so far discovered.

Mosaic. A virus disease first reported in 1916. Symptoms. Dwarfing, mottling and crinkling of the leaves occur with a distinct downward cupping. Affected plants are usually paler green and more dwarfed ; often the plant grows bushy and remains green till frost. Few or no pods are set in early infection, while late infection may be comparatively harmless.

The pea and medium type beans are somewhat susceptible. Robust pea bean is almost immune, while Red Kidney, White Marrow and Yellow Eye are not affected to any extent.

Canada. Information on the methods of bean growing in Canada is less precise than in the case of U.S.A. (Annual Reports of the Minister of Agriculture, and Annual Reports and Reports of the Dominion of Canada Experimental Stations.)

In Alberta, Canada, beans are attracting more attention through an increasing market and from the fact that they form a good companion crop to sugar beet which is developing in this province. The beans are planted and cultivated with the sugar beet drill and cultivator and in point of time are planted just after the sugar beets and harvested before them. A crop of beans leaves the land well prepared for sugar beet. Harvesting is done by means of bean pullers and threshing by ordinary grain separators with a few temporary modifications.

Many of the Dominion Experimental Stations have carried out trials with haricot beans, in particular, Lethbridge, South Alberta ; Fort Vermilion, N. Alberta ; Rosthern, Saskatchewan ; Morden, S. Manitoba ; Lennoxville, Quebec Province.

The mean temperatures of the growing season (May to September) for these stations do not vary more than 2 degrees above or below that of south-east England (58° F.) while the total normal rainfall for the same period does not differ from south-east England by more than about 2 in.

The beans were usually sown on or about May 15th. At Lethbridge beans sown on a series of days before May 10th ripened no earlier than beans sown on that date.

There the best rate of seeding the small white beans was not lower than 45 lb. per acre in rows 22 in. apart. No gain resulted from seeding at 75 lb. per acre.

The longest time taken to reach maturity was 119 days by Burbank Navy at Fort Vermilion, mean growing season temperature 57° F. The same variety took only 108 days at Lennoxville where the mean growing season temperature was 61° F. and the rainfall much higher. The yield at Fort Vermilion was 16·5 bushels per acre, at Lennoxville 39 bushels per acre.

The bean taking the shortest time to reach maturity, while providing one of the highest yields, was the Navy Pea selection, Ottawa 711, at Lennoxville ; time to maturity 102 days, yield 34 bushels per acre.

The following are the principal varieties grown successfully at the experimental stations in Canada. Details concerning them will be found in the appendix.

Beauty	Lethbridge, Rosthern.
Burbank Navy	Fort Vermilion, Lethbridge, Lennoxville.
Darling (Navy Pea type)	Morden.
Early Wonder (Navy Pea type)	Morden.
Gohns Rainy River	Fort Vermilion.
Great Northern	Lethbridge.
Hunter (Navy Pea type)	Morden.
Jones White	Morden.
Lady Washington	Morden.
Large White	Morden.
Navy Ottawa 711	Lennoxville.
Navy Pea (White Pea)	Fort Vermilion, Morden.
Navy Pilot	Morden.
Norwegian 710	Fort Vermilion.
Robust	Morden.
Snowflake	Morden.
Yellow Eye Improved	Lennoxville.

III. Trials in Great Britain.

In Great Britain the cultivation of beans for haricots has been neglected for reasons already given, i.e. they are considered to be unprofitable by the farmer and the housewife in the main only regards them favourably when canned.

In 1919 the Royal Horticultural Society conducted trials at Wisley with dwarf French beans (Anon., R.H.S., 1920). Although the trials were for beans to be harvested as snapbeans information was obtained which has useful bearing upon beans grown for haricots. A point of some importance is that, whereas with snapbeans those which produce their pods over a long season are the more desirable (except, perhaps, to the market gardener who may want to clear his ground), the most suitable types for haricot are those which mature their pods simultaneously and, of course, early.

In 1939 the Ministry of Agriculture sponsored trials with a few varieties of dwarf French bean to test their suitability for haricots in this country (Anon., R.H.S., 1940, Anon., Minist. Agric., 1940). None of these was of varieties usually grown for dry beans in Canada or U.S.A. but two, Brown Dutch and Comtesse de Chambord, are well known as dry bean varieties on the continent. The former was introduced by the R.H.S. during the last war (1917) and became very popular as a haricot bean.

The trials took place at a number of widely separated centres and under conditions approximating to commercial practice.

The most successful results were obtained in the undermentioned Institutions :—

I. Midland Agricultural College, Sutton Bonington, Leicester.
II. Horticultural Research Station, Cambridge.
III. Royal Horticultural Society's Gardens, Wisley, Surrey.
IV. Cannington Court Farm Institute, Somerset.
V. South-Eastern Agricultural College, Wye, Kent.
VI. John Innes Horticultural Institution, Merton, Surrey.

The beans were also grown in Hampshire, Lincolnshire, Lancashire, and Durham with less successful results.

The weather was unfavourable, a cold dry summer followed by a wet autumn made natural harvesting impossible and the crop had to be dried artificially. Under farm conditions, it is reported, the cultivation of successful bean crops of these varieties would have been difficult, though they could be relied on to mature their crops between May and September. In 1940 with its exceptionally fine summer beans matured without difficulty.

There was much damage from birds and animals in some places.

The varieties grown in 1939 at Wisley were Brown Dutch, Inépuisable (syn. Everbearing), White Leviathan, Masterpiece, Comtesse de Chambord, and a climbimg type, Prédome à rames, which has now been discarded.

From the evidence of these trials and from further data obtained in 1940 Comtesse de Chambord appears to be particularly suited to English conditions from the point of view of growth and cropping capacity, reasonably early maturity, resistance to adverse weather conditions, appearance as finished product and edibility when cooked.

Brown Dutch is awarded second place.

The estimated yield per acre at Wisley (the only centre from which full returns have been published) is : Comtesse de Chambord, 22 cwt. ; Brown Dutch, 18½ cwt. ; Masterpiece, 17 cwt. ; Inépuisable, 16 cwt. ; White Leviathan, 16 cwt. From the Cambridge trial it is reported that Inépuisable was the only variety in an unfavourable season which could have been harvested without artificial drying if it had been grown on a commercial scale.

Mr. A. D. Turner, Horticultural Superintendent to Somerset County Council, has recently grown Comtesse de Chambord in bulk. The extracts from his letter on the subject which are given below provide useful first-hand information on successful cultivation under English conditions.

The date of sowing was May 6th. Harvested at the end of September. Actual yield for ⅓ acre, 6 cwt. of cleaned seed.

" We continued with a number of varieties which we grew in 1939 and selected Comtesse de Chambord (Rice Bean) as the most likely one required by manufacturers. With this variety in 1939 and 1940 we found that seeding of 14 lb. to 16 lb. per acre was about the weight required ; the rows being 27 in. apart, plants about 6 in. At this sowing 1 lb. sown gave 1 cwt. crop. We found the plants succeeded best when sown in dry soil with no rain occurring during germination. Under these conditions our crop was up in rows in four days without loss of plants and no damage by slugs.

We grew ⅓ of an acre to get experience of handling a bulk crop.

The plants were allowed to remain until all the leaves had yellowed. They were then pulled by hand and left in rows for the older leaves to drop off. When the weather appeared settled to be damp the crop was collected on a dry day and stacked in a lean-to shed in narrow rows, roots inwards and a drying alley between.

In October when a corn thresher was working near, the crop was taken to the machine together with crops of seed peas we had to thresh and the beans were put through without very much difficulty. The thresher has a drum screen of the bar or coiled spring type which can be adjusted to let the sizes of seeds through. We found that by adjusting the beaters there was very little breaking of the seed because the pods and seed were dry.

Our seed came out clean of any dust or rubbish. The pods had all been emptied and the brush on the drum had been sufficient to polish the seeds.

After threshing the seed was spread in a room at about 55° F. and left to harden for about three weeks. It has since been hand-picked to get the few stray pea seeds away which came from the previous crop through the thresher.

The corn thresher was a Marshall, but I think any type of machine would have adjusting gear to adapt it to various types of seeds."

Inépuisable or Everbearing was another bean which yielded well in the Somerset trials. This bean sown the first week in May was harvested at the end of August. The yield per acre was estimated (from a 51 foot row) at 13 cwt. 90⅜ lb. Under the same conditions Comtesse de Chambord was estimated to yield 14 cwt. 82½ lb. per acre. Grown in bulk (see above) ⅓ acre of Chambord yielded 6 cwt. = 18 cwt. per acre.

In conclusion it should be noted that the seed of four excellent varieties of haricot is likely to be available in quantity so that difficulty in obtaining a supply should not arise. These varieties are Comtesse de Chambord, Everbearing (Inépuisable), the Pea Bean (Navy Pea) and Red Kidney.

IV. Notes on garden cultivation in Great Britain.

Sow from end of April to middle of May, taking May 10th as the optimum date in suitable weather. Too early sowing brings more risk than profit, while too late sowing may result in failure to ripen the crop.

Light dry soil is to be preferred, not too rich.

Manure is unnecessary in garden soil well manured for a previous crop, and especially if the beans follow potatoes. A dressing of lime, however, may be given before the seeds are sown. If manure is thought necessary a phosphatic manure should be used.

A suitable spacing is 1½ ft.-2 ft. between the rows with the plants thinned to 6 in. apart in the rows. In the absence of experiments this is considered to allow of the maximum number of plants possible without risking reduction of yield through overcrowding. (Spacing in America for mechanically cultivated field beans of the pea bean type is 28 in. × 6 in. This is not to say that it is the optimum for yield, but it is convenient for purposes of mechanical cultivation.)

Sowing depth should be from 2-3 in.; not more than 2 in. on heavy soil.

Garden grown beans can receive more care than is possible in the field. Attentions which will improve results are dusting the ground with lime and soot before sowing and at intervals during growth to ward off slugs, etc., watering if the weather be very dry and frequent use of the hoe.

Some of the taller sorts may show a tendency to straggle and since it is important that the pods should be kept clear of the ground they may be supported between lines of short twiggy sticks.

Beans grown for haricots must be reserved for this purpose only. If immature pods are taken from the plants for use as green beans it prolongs the growing season and defers ripening.

The time to harvest the crop is when the majority of the pods have turned colour. The drying may have to be finished under cover, in which case the least troublesome method is to harvest the plants entire and hang them up in bunches or spread them out under cover on floor or bench. When the pods are completely dry a simple way of extracting the seed is to put the plants into a sack and beat it.

Varieties. While almost any garden-grown dwarf bean in a dry state can be used for culinary purposes the following are recommended to be grown especially for the purpose (for descriptions, etc., see Appendix).

Brown Dutch.
Chevrier Vert (Green Gem).

Comtesse de Chambord (White Rice).
Navy Pea Bean or its many varieties.
Ne Plus Ultra.
Red Kidney.
White Leviathan.

Of these the best is Comtesse de Chambord, outstanding both for garden behaviour and for the culinary quality of its diminutive beans.

Chevrier Vert has excellent flavour and is of an attractive green colour which it maintains to a greater or less extent when cooked.

Red Kidney will also arrive at table with its pleasing colour unimpaired (described by Hedrick as varying from jasper pink to garnet brown).

It may be noted that dried seeds of runner beans make an excellent haricot bean. Gardeners should make a point of reserving the surplus pods for this purpose.

V. Cooking.

Cookery books, however much they may differ in detail, are unanimous in asserting that dried haricot beans must be boiled for a very long time. This opinion is probably partly responsible for the infrequent appearance of the beans at table.

Experiment, however, has shown that the time required for cooking is influenced by the time occupied in the preliminary soaking, by the age of the beans and possibly by whether the water in which they are boiled be hard or soft.

Beans soaked for 24 hours before cooking instead of for the 12 hours usually recommended, if less than six months harvested, should be ready to serve after boiling for an hour. Beans which have been harvested for a longer period and have hardened will need 1½ hours. These times present a material reduction on those generally advocated and refer to the smaller beans. Large beans may require slightly longer.

The compiler has found that after a preliminary soaking for 12 hours, beans are perfectly cooked in a high pressure cooker after 15 minutes.

Acknowledgments.

The Bureau is grateful for much information received from the following :—

Mr. D. Boyes, Director of the Horticultural Research Station, Cambridge.
Mr. F. C. Brown, Royal Horticultural Society's Gardens, Wisley.
Mr. F. J. Chittenden, Royal Horticultural Society's Gardens, Wisley.
Mr. R. L. Harrow, Director of the Royal Horticultural Society's Gardens at Wisley.
Mr. A. D. Turner, Horticultural Superintendent, Somerset C.C.

It particularly thanks Dr. H. V. Taylor, Horticulture Commissioner, Ministry of Agriculture, Whitehall, for his helpful suggestions and for contributing a short foreword.

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VI. Appendix.

Notes on varieties mentioned.

Beauty. Not described. Grown at Rosthern, Canada, and gave good results.

Blue Pod. Apparently a break from Small White, a Californian strain of Navy Bean, among which blue pod beans resembling this selection are often found. Matures a week earlier. Susceptible to all common bean diseases.

Boston Pea Bean. Synonym of Navy Pea bean. Selections from these beans were made at Cambridge Horticultural Research Station, England, 1931.

Brown Dutch. R.H.S. trials at Wisley, 1930. Pods held well above soil, ripens well, shells easily. Estimated yield in R.H.S. trials, 18½ cwt. per acre at Wisley, 11¼ cwt. per acre at John Innes Institution, Merton. Ready as haricot end of September. Resembles Hedrick's description of Brown Holland, which he describes as early and very productive.

This bean was introduced by the R.H.S. in 1917 for use as a haricot and became well known and widely grown at the time. It was found to be an excellent cropper and of first class flavour. There is an inferior form which also figured in the trials conducted by the R.H.S. in 1919. This is characterized by smaller pods, smaller seeds, and lower yield. The inferior types were received under the names African Brown, South African Brown, Brown Haricot Dutch Type, Dwarf Dutch Brown, Dutch Brown.

The descriptions are as follows: Brown Dutch (true). Plant vigorous; 18 in. high. Pods numerous, 5-5½ in. long, almost straight, roundish, about ½ in. in diameter, fairly smooth, light green, somewhat bulged over bean, stringy and soon tough; flesh of medium thickness. Seeds 4-5 in a pod, medium size, roundish oval, generally rounded at end. Ripens well, shells easily.

Brown Dutch and synonyms (Inferior type). Differs from the true strain as under. Plant 14 in. high; pods 4-4½ in. long, scarcely bulging over seeds, flesh rather thinner, small, round in section, often truncate at the end. Diameter of pod and number of seeds are ½ in. and up to 5 respectively as in the true variety. Ripens well, shells easily.

True variety reported from the trials at Horticultural Research Station, Cambridge, 1939, in an unfavourable season, as evidently requiring early sowing and a warm summer.

Brown Swedish. Said to have been brought by immigrants from Sweden to U.S.A. before 1890. Seeds small-medium (95-100 per oz.), colour light brown. Favourite in Northern Michigan, Wisconsin and Minnesota. Susceptible to blight and anthracnose.

Burbank. Small white bean, probably a variety, of which there are over a hundred, of the Navy Pea bean. Grown successfully in Canada at the Experiment Stations at Fort Vermilion, Lethbridge, Morden, Lennoxville. Requires about 119 days to ripen. Yield 16·5 bushels per acre.

Burlingame. Barely distinguishable from Navy Pea bean, except that pods are broad rather than slender. Seeds smaller and pearly white, lacking the faint grey veining of Navy.

Californian Cream. A very old variety now nearly always listed as Sulphur. Seeds small-medium (75-80 per oz.), cream–light sulphur yellow. In season with Navy Pea. Possesses a distinctive flavour which makes it appreciated by some for soup or baking. Yield only moderate. Disease resistant.

Canadian Wonder. The term Canadian Wonder has by now become almost a generic term on account of the diversity of types. In the R.H.S. trials in 1919 two quite distinct races were included, the one with larger, paler foliage, larger seeds and longer pods, the other smaller in all parts, darker and later. Between these are some intermediate forms, but many of the stocks now on the market contain the larger and the smaller forms. In U.S.A. used chiefly as a dry shell bean. Seeds large (45-50 per oz.). Colour ox-blood red which fades when cooked. Late in maturing.

Chevrier Vert. Roi des Verts. King of the Greens. Green Haricot. Dwarf Green. The beans are considered desirable for the table by some because of their attractive green colour when ripe, but to obtain it unaltered the seeds must be harvested before they are fully ripe. The flavour is delicate compared to many others. In the R.H.S. trials of 1919 the varieties given above are practically identical,

differences probably lying in the power of retaining the green colour of the seeds. The pods are in large loose clusters held well above the soil. Seeds up to 5, medium size.

Comtesse de Chambord. Dwarf White Rice. R.H.S. trials 1919 and 1939. Low spreading, almost semi-climbing, not requiring support. Pods just off the soil. Seeds white, very small. Ripens well; easy to shell. Ready as haricot end of September. Estimated yield per acre at Wisley, 1939, 22 cwt., at John Innes Institution, Merton, 27½ cwt., at Somerset Farm Institute, grown under field conditions, 18 cwt.

This bean, probably the smallest-seeded of all, is one of the most recommended and has figured successfully in trials at the R.H.S. and at the Cambridge Horticultural Research Station. Both in the unfavourable season of 1939 and in the hot summer of 1940 it ripened well, though it was dried off under cover. The flavour is excellent and the appearance when cooked is attractive.

Mr. Boyes, Director of the Horticultural Research Station, Cambridge, has selected an early ripening strain of which Messrs. Cooper, Taber & Co. are growing a small acreage. They are at time of writing uncertain whether they will have any for distribution. Writing of the unselected strain Messrs. Sutton & Sons say, "This sort (Comtesse de Chambord) is a later podding one and, although this year it has ripened well with us (Reading) it is usually much later in forming pods than most of the British kinds and requires a good summer, such as the present one, to be entirely successful." Messrs. Watkins & Simpson recommend Comtesse de Chambord. The beans were harvested about September 10th at Feltham. "We have had some very fine hot weather and normally they would have been a little later in ripening." Scarcely known in U.S.A.

Danubian White. Hungarian Bean. In 1931 and 1932 stocks of Danubian White were grown at the Horticultural Research Station, Cambridge, and a number of selections made. The yield varied from 101-663 ripe seeds per plant.

When grown at Wisley in 1940, matured the same time as Comtesse de Chambord but was considered to be distinct from this variety.

Darling. Navy Pea type. Grown successfully at Morden, Canada.

Early Wonder. An English variety. Gained Award of Merit in the Wisley trials, 1919, where it is noted as holding its pods more or less above the soil. The seeds are small, reddish-brown with black splashes. Red flowered. An Early Wonder was placed first in order of Merit out of 10 successful varieties at Morden Experiment Station, Canada, and in 1928 (the date of the last report) noted as reaching maturity in adverse weather conditions. It is described as of the pea-bean type and is therefore probably not identical with the English variety.

Everbearing, see Inépuisable.

Gohn's Rainy River. Grown successfully at Fort Vermilion Experimental Station, Canada, 1938, where it ripened in 114 days, the season being exceptionally favourable. Yield 14 bushels per acre.

Granda. A white-seeded variety now on trial as a haricot at the R.H.S. Wisley. It is some three weeks earlier than Comtesse de Chambord. The seeds are somewhat larger. Carter's 1940 catalogue lists it as a novelty—though not as a haricot—"Of outstanding merit". The plant is sturdy in growth, the pods hang in profusion well out from the plant.

Great Northern. Originally grown by Mandan Indians and introduced to commerce in 1907. Hardier, earlier and more productive than Navy Pea bean. Very disease resistant and yields well under irrigation. Grown experimentally in Canada at Lethbridge Experimental Station and commercially in Montana, U.S.A. Seeds slightly larger than Navy bean, colour white.

Hungarian, see Danubian White.

Hunter. Navy Pea type. Small white bean, earlier than Robust. Grown successfully at Morden Experimental Station, Canada.

Inépuisable. Everbearing. R.H.S. trials at Wisley, 1939. Flowers in very large clusters well above foliage; many fail to set. Ripens well and shells easily. Ready as dry bean about mid-September. In the 1919 trials two strains emerged, distinguishable only by time of ripening. *Everbearing* of Sutton, Barr and R. Veitch was earlier than the synonymous *Inépuisable* of Vilmorin. The bean gives a fair crop but is less prolific than Comtesse de Chambord or Brown Dutch. The seed is harder than that of Chambord.

In the trials at the Horticultural Research Station, Cambridge, 1939, in a cold wet season two-thirds of its crop ripened, following a late sowing, before the end of September without artificial drying. Not of the type used as a dry bean in America.

Japanese Haricots. A few varieties have been tried at Wisley. Their cropping qualities are inferior.

Jones' White. Grown successfully at Morden Experimental Station, Canada.

Lady Washington. Supposed by Hedrick to be Coscarron media, the native bean of Chile. Introduced to U.S.A. before 1850 and again in 1891. Slightly later than pea bean and seed flatter and slightly larger, 145 to ounce. Soup or baking bean; goes soft in canning and is therefore unsuitable. Grown successfully at Morden Experimental Station, Canada. The principal variety in S. Washington, Oregon, N. Idaho. Susceptible to common diseases.

Large White. Hedrick says it is a synonym of Robust. Grown as separate variety at Morden Experimental Station, Canada.

Leviathan, see White Leviathan.

Masterpiece. R.H.S. trials, 1919 and 1939, and Horticultural Research Station, Cambridge, 1939. The ends of the pods are liable to rest on the ground with the result that the seeds at the extremities may rot. Seeds pale dun, 3-5 in pod, large, 60-65 per oz. Sown May, ready as haricot early September. Estimated yield at Wisley 17 cwt. per acre. It is considered a good cropper. Cooks well. Opinion on flavour appears to be divided.

Michigan Pea. Probably a synonym of Robust.

Michigan Robust. Synonym of Robust.

Navy Pea. Originally cultivated by the Indians, New York State. It has been much selected and there are innumerable varieties and synonyms so that the name has become that of a type rather than of a definite variety. It is the principal field variety of U.S.A. Matures in 120 days. Used universally as home baked bean and as commercial canned bean. Practically failed at Rosthern, Canada, over five years. Canadian Department of Agriculture selection Navy (Ottawa 711) did well at Lennoxville, Quebec and at Morden Experimental Stations and required

only 102 days to mature. Yield 34 bushels per acre. Susceptible to all bean diseases. Seeds small, 130 per oz. Colour white, lightly veined grey.

Navy Pilot. Introduced to U.S.A. in 1913. Typical Navy in pod and pea, height and vining habit ; distinctive in large broad leaflets and earlier maturity. Skin thin, cooking quality excellent. Grown successfully at Morden Experimental Station, Canada.

Ne Plus Ultra. There are at least two distinct strains of this English variety as was revealed at the R.H.S. Dwarf Bean trials in 1919. The descriptions are as follows. (Points of difference in italics.)

Ne Plus Ultra, selected strain (Sutton). Plant vigorous 18 *in.*, dark green ; pods numerous, up to 6 in., somewhat curved near the point ; *flattish* $\frac{1}{2}$-$\frac{5}{8}$ in. broad, rather rough, *medium dull green* ; *flesh thick,* becoming stringy when *aged, parchment medium* ; seeds up to 5 per pod but rather apt to miss, seeds medium *but rather longer* than true Brown Dutch, which they resemble in colour. Shells easily.

Ne Plus Ultra. (Watkins and Simpson, Cooling.) Plant vigorous, 16 *in.*, dark green, pods numerous up to 6 in., rather curved, *fairly round,* nearly $\frac{1}{2}$ in. broad, rather rough, *light bright green* ; *flesh rather thin with little parchment, but soon* becoming stringy ; seeds up to 5 per pod. Ripe seed similar in colour to or darker than true Brown Dutch but *smaller and narrower.* Shells easily.

Both strains of Ne Plus Ultra have a smaller crop than some but can be relied on to ripen in an unfavourable season and before autumn wet weather sets in.

Norwegian 710. A strain selected by the Department of Agriculture, Canada. Grown successfully in Canada at Fort Vermilion and Rosthern Experimental Stations. It reached maturity in 108 days in a favourable season in 1938. Yielded 21 bushels per acre.

Nova Scotia Marrow. Said to be grown in the Maritime Provinces of Canada and it has a long history of selection in U.S.A. It has, in U.S.A., since shown reduced disease resistance. The dry bean splits too easily. Seeds large, 45 per oz., white, often wrinkled. Early. It has lost popularity.

Perry Marrow. At present a mixture of strains from crosses between White Marrow and Wells Red Kidney, first distributed 1922 in U.S.A. Seed medium—large, 45-50 per oz., glossy white with faint greyish veining and pale yellowish eye ring. Apparently immune to anthracnose.

Princess d'Artois. A dwarf garden type grown by the Division of Horticulture, Canada, 1938, as a snapbean ; was found to reach full maturity earlier than any others. It is white-seeded.

Red Kidney. A medium to large bean, 40-60 per oz. Jasper pink-garnet brown, colour varying between and within strains, of which there are many. Known in eastern U.S.A. before 1857. Forms the greater part of the bean export trade from U.S.A. to West Indies, also used in canning. Intermediate in season for field beans. Second in importance in Michigan and Finger Lake District, N.Y. (high rainfall areas). Resistant to mosaic, susceptible to anthracnose and blight.

Robust. One of the most widely grown of the small pea beans originally selected from a large collection of White Navy beans for mosaic resistance (1913). A reselection in 1921 named Improved Robust was not superior in yield to original but served to re-establish a pure strain. Later (about seven days) than some Navy Pea bean strains but matured successfully at Morden Experimental Station, Canada,

even in unfavourable seasons. Fast displacing all other strains in the bean districts of Michigan and New York. Resistant to anthracnose and blight, and almost so to mosaic. Seeds small, 130 per oz., dull white, more numerous and darker grey veining than Navy.

Snowflake. Introduced to U.S.A., 1888. Seeds about the same size as Navy Pea; possibly less productive. Grown at Morden Experimental Station, Canada, successfully but placed last of 10 varieties in order of merit. Reached maturity there in a bad season.

Wells Red Kidney. From a single plant selection made in 1904. Seed rather lighter-coloured than Red Kidney. Very resistant to anthracnose.

White Kidney. Similar to Red Kidney but later, and with large white seed, 45-50 per oz.

White Lental. Apparently identical with a Siberian variety grown in U.S.A. as Small White Ekaterinoslav. Beans very small, cream coloured. Flavour reported exceptionally good. Very early, ripens evenly and yields well.

White Leviathan. White Haricot. Dunkin's Dwarf. The report on White Leviathan from the trials at the Horticultural Research Station, Cambridge, 1939, describes it as being more suitable for use in the unripe state than for dried seeds. In addition to being late the pods were so long that the majority rested in part on the ground, rendering them liable to rot, with consequent deterioration of the seed in the parts affected. Reports of the R.H.S. trials at Wisley 1919 and 1939 describe the seeds as white, 6 to a pod, rather large, some with greenish tint, ripens well and shells easily. Pods held well above soil, in large clusters. Ready as haricot mid-September. Estimated yield 16 cwt. per acre at Wisley.

White Marrow. More widely listed in U.S.A. than any field bean except Red Kidney, though grown on smaller acreages than Navy and Boston Pea bean. Seed white, medium size, 80 per oz.

White Pea Bean. Synonym of Navy Pea. Grown successfully in Canada, Fort Vermilion, taking 112 days to reach maturity in a favourable season, 1938. Yield 16 bushels per acre.

Yellow Eye Improved. A very old variety and variable through environmental conditions, breeding and selection, thus much confused in bean literature. Improved Yellow Eye (or Molasses Face) is most commonly grown for the Boston Market. At Lennoxville, Quebec Province, matured in 108 days, yielding 39 bushels per acre. Bean white with light brown markings at eye. Medium, early, very hardy, prolific, disease resistant.

York State Medium. Synonym of Burlingame.